Geotechnical Evaluation Report

Divide Avenue Reconstruction
Between Volk Drive and East Bismarck Expressway
Bismarck, North Dakota

Prepared for

Kadrmas, Lee & Jackson, Inc.

Professional Certification:
I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Registered Professional Engineer under the laws of the State of North Dakota.

Mark E. Kvas, PE
Project Engineer
License Number: PE-6392
August 22, 2011

Project BM-11-02045

Braun Intertec Corporation

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August 22, 2011

Project BM-11-02045

Mr. Troy Ripplinger
Kadrmas, Lee & Jackson, Inc.
P.O. Box 1157
Bismarck, ND 58502-1157

Re: Geotechnical Evaluation
Divide Avenue Reconstruction
Between Volk Drive and East Bismarck Expressway
Bismarck, North Dakota

Dear Mr. Ripplinger:

We are pleased to present this Geotechnical Evaluation Report for the above-mentioned project. A summary of our results, and a summary of our recommendations in light of the geotechnical issues influencing design and construction, is presented below. More detailed information and recommendations follow.

Summary of Results

We completed six (6) standard penetration test borings along the existing alignment and two (2) standard penetration test borings along the proposed alignment. The borings along the existing alignment encountered approximately 3 1/2 to 5 inches of bituminous surfacing over approximately 3 to 9 inches of old aggregate base material. Below the old aggregate base and existing topsoil (along the proposed alignment), the borings encountered fill and buried topsoil to approximate depths ranging from 1 1/2 to 9 feet. Under the existing fills and buried topsoils, the borings encountered alluvial soils and material likely associated with the Hell Creek Formation. The alluvial soils consisted of silty sand, sandy silt, silt, lean clay, and fat clay. The Hell Creek Formation consisted of very soft, decomposed claystone, shale, and sandstone.

Groundwater was observed in Boring ST-5 at a depth of 4 feet, corresponding to an elevation of 1674 1/2, while drilling and in Boring ST-8 at a depth of 20 feet, corresponding to an elevation of 1701, while drilling. Seasonal and annual fluctuations should be anticipated.

Summary of Recommendations

Utilities

It appears from the borings that fat clays, lean clays, and silty sands will be encountered at the utility invert elevations. It is our opinion these soils will be suitable for support of the proposed utilities. Dewatering of the utility trenches will not likely be necessary along the alignment except near Hay Creek.

Pavement

We recommend the existing pavements be completely removed. We recommend the upper one (1) foot of the resulting subgrade be scarified, thoroughly mixed, moistened to a moisture content near optimum, and compacted to a minimum of 95 percent of its standard Proctor maximum dry density. On-site or imported backfills and fills should then be placed and compacted to desired grades.

Based on the soils observed in the borings and the results of our laboratory tests, we recommend the pavements be designed for a subgrade with a California Bearing Ratio (CBR) of 2.

Remarks

Thank you for making Braun Intertec your geotechnical consultant for this project. If you have questions about this report, or if there are other services that we can provide in support of our work to date, please call Mark Kvas at 701.255.7180 or by email at mkvas@braunintertec.com.

Sincerely,

BRAUN INTERTEC CORPORATION

Mark E. Kvas, PE
Project Engineer

for Sean S. Swartz, PE
Principal/Senior Engineer

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Appendix

A. Introduction

A.1. Project Description

This Geotechnical Evaluation Report addresses the reconstruction and new alignment of Divide Avenue between Volk Drive and East Bismarck Expressway in Bismarck, North Dakota. The scope of the project is illustrated in the Boring Location Sketch in the Appendix.

It is our understanding that Divide Avenue will be reconstructed and utilities will be installed/replaced along the alignment. The roadway will be widened to a width of 48 feet and will consist of an urban section with curb and gutter. New storm sewer and water main utilities will be installed/replaced along the alignment. New box culverts will be placed at Hay Creek. Grade changes have not been determined as of the date of this report, however we anticipate that grades along the alignment will generally remain the same with the exception of the cut area on the east side of the alignment.

A.2. Purpose

The purpose of this geotechnical evaluation was to assist KL&J in designing the proposed pavements, and in preparing plans and specifications for installation of the utilities and reconstruction of the streets.

A.3. Background Information and Reference Documents

To facilitate our evaluation, we were provided with or reviewed the following information or documents:

- An AutoCAD file of the site which indicated the alignment.
- Aerial photograph of the site from Google Earth™.

A.4. Site Conditions

Divide Avenue is currently a bituminous-surfaced, two-lane, 24-foot wide, rural section. Away from the pavement there are no defined ditches, as grades gently slope down and away from the pavement. A bike trail runs parallel on the south side of the roadway from the west to Hay Creek.

The existing alignment slopes down from west and east toward Hay Creek. Ground surface elevations measured at the boring locations range from about 1767 feet at the west end (Boring ST-1) to 1678 feet (ST-5 near Hay Creek) and up to 1722 (ST-7) at the east end. The new portion of the alignment will begin approximately 300 feet east of Hay Creek and will continue straight east to connect with Commerce Drive (approximately 900 feet). The new alignment will cross through undeveloped green areas and gravel parking lots.

A.5. Scope of Services

Our scope of services for this project was originally submitted as a Proposal to Mr. Nick West of Kadrmas, Lee & Jackson, Inc. (KL&J). We received authorization to proceed from Mr. Troy Ripplinger with KL&J on July 8, 2011 with a Standard Form of Agreement between Engineer and Consultant for Professional Services. Tasks performed in accordance with our authorized scope of services included:

- Staking and clearing exploration locations of underground utilities.
- Performing 10 penetration test borings to depths ranging from 20 to 30 feet.
- Performing laboratory tests on selected penetration test samples.
- Performing laboratory tests on the bulk samples.
- Preparing this report containing a CAD sketch, exploration logs, a summary of the geologic materials encountered, results of laboratory tests, and recommendations for the roadway construction.

We staked the exploration locations by estimating their positions from the provided aerial photograph. After our field work was completed, KL&J surveyed the boring locations and provided us with their ground surface elevations.

Our scope of services was performed under the terms of the Standard Form of Agreement between Engineer and Consultant for Professional Services.

B. Results

B.1. Exploration Logs

B.1.a. Log of Boring Sheets

Log of Boring sheets for our penetration test borings are included in the Appendix. The logs identify and describe the geologic materials that were penetrated, and present the results of penetration resistance, laboratory tests performed on penetration test samples retrieved from them, and groundwater measurements.

Strata boundaries were inferred from changes in the penetration test samples and the auger cuttings. Because sampling was not performed continuously, the strata boundary depths are only approximate. The boundary depths likely vary away from the boring locations, and the boundaries themselves may also occur as gradual rather than abrupt transitions.

B.1.b. Geologic Origins

Geologic origins assigned to the materials shown on the logs and referenced within this report were based on: (1) a review of the background information and reference documents cited above, (2) visual classification of the various geologic material samples retrieved during the course of our subsurface exploration, (3) penetration resistance, (4) laboratory test results, and (5) available common knowledge of the geologic processes and environments that have impacted the site and surrounding area in the past.

B.2. Geologic Profile

B.2.a. Geologic Materials

We completed six (6) standard penetration test borings along the existing alignment and two (2) standard penetration test borings along the proposed alignment. The borings along the existing alignment encountered pavements consisting of approximately 3 1/2 to 5 inches of bituminous surfacing over 3 to 9 inches of old aggregate base material. The borings performed along the new alignment encountered vegetation and 4 to 4 1/2 feet of clayey fill at the surface.

Below the pavement, the borings encountered fill and buried topsoil to approximate depths ranging from 1 1/2 to 9 feet. Under the existing fills and buried topsoils, the borings encountered alluvial soils and material associated with the Hell Creek Formation. The alluvial soils consisted of silty sand, sandy silt, silt, lean clay, and fat clay. The Hell Creek Formation consisted of very soft, decomposed claystone, shale, and sandstone. We wish to note that it appears that the material associated with the Hell Creek Formation can be excavated with typical construction equipment.

The following table summarizes the pavement and subgrade conditions encountered within 5 feet of existing grades at the boring locations.

Table 1. Summary of Pavement and Subgrade Conditions

Boring	Bituminous Thickness (inches)	Aggregate Base Thickness (inches)	Subgrade Summary Down to a Depth of 5 feet*
ST-1	4	8	1 1/2' brn & gry CH Fill over gry CLST
ST-2	5	4	4' brn & gry CH Fill over gry SH
ST-3	5	7 1/2	4' brn, dk brn, & gry CH Fill over brn SM Fill
ST-4	3 1/2	8	1 1/2' dk brn & brn mixed CL & CH Fill over gry SH
ST-5	5	9	2' dk brn & brn mixed CL & CH Fill over 2' brn SM Fill over brn SM
ST-6	--	--	1 1/2' dk brn & brn SM Fill over 2 1/2' of CL Fill over brn SH
ST-7	--	--	4 1/2' dk brn & brn CL Fill over ML
ST-8	4	9	dk brn & brn mixed CL & CH

* SM = Silty Sand, CH = Fat Clay, CL = Lean Clay, ML = Silt, CLST = Claystone, SH = Shale, brn = brown, dk = dark, gry = gray.

Penetration resistance values recorded in the fills ranged from 5 to 20 blows per foot (BPF), indicating they were not uniformly compacted. Penetration resistance values recorded in the alluvial soils ranged from 4 to 11 BPF, indicating they were very loose/rather soft to medium dense/rather stiff.

B.2.b. Groundwater

Groundwater was observed in Boring ST-5 at a depth of 4 feet, corresponding to an elevation of 1674 ½, which was the boring performed at the lowest elevation. Boring ST-8, performed along Commerce Drive, encountered groundwater at a depth of 20 feet, corresponding to an elevation of 1701. Seasonal and annual fluctuations of groundwater, however, should be anticipated.

B.3. Laboratory Test Results

B.3.a. Moisture Content Tests

We performed a total of 29 moisture content (MC) tests that we used to aid in our classifications and estimations of the soils' engineering properties. The moisture contents of the materials tested ranged from 17 to 39 percent with the majority of the samples ranging from 22 to 30 percent, indicating they were generally near optimum. The results of the moisture content tests are listed in the "MC" column of the Log of Boring Sheets attached in the Appendix.

B.3.b. Atterberg Limits Tests

We performed five (5) Atterberg limits test on selected samples for classification and evaluation of the range of soil plasticity. The test indicated the clays had a liquid limits (LL) ranging from 48 to 69, plastic limits (PL) ranging from 19 to 26, and plasticity indies (PI) ranging from 26 to 47, indicating the soils are both lean clay and fat clay classified under ASTM symbol "CL" and "CH".

B.3.c. Standard Proctor and CBR Tests

Bulk soil samples were collected from the auger cuttings at numerous borings. We combined samples from Borings ST-1 and ST-2 from a depth approximately from 1 to 5 feet, and also from Borings ST-3 and ST-8 from a depth approximately from 1 to 5 feet, for evaluation of their standard Proctor maximum dry densities and California Bearing Ratios (CBR).

The CBR tests were performed on remolded samples compacted to 95% of the standard Proctor maximum dry density and at optimum moisture content. Table 2 below summarizes the results of these tests.

Table 2. CBR and Standard Proctor Test Results

Parameter	Borings ST-1 and ST-2 (≈1'- 5')	Borings ST-3 and ST-8 (≈1'- 5')
Soil Classification	CH (Fat Clay)	CH (Fat Clay)
Maximum Standard Proctor Dry Density (lbs/ft^3)	95.1	102.5
Optimum Moisture (%)	23.0	18.8
CBR @ 95 % Maximum Standard Proctor Density	2.3	2.4

C. Basis for Recommendations

C.1. Design Details

C.1.a. Proposed Construction

The existing roadway consists of a 24-foot wide, two-lane bituminous-surfaced rural section with no discernible ditches. Mr. Ripplinger indicated the roadway will be widened to a width of 48 feet and will consist of an urban section with curb and gutter. New storm sewer and water main utilities will be installed/replaced along the alignment. New box culverts will be placed at Hay Creek. Grade changes have not been determined as of the date of this report, however we anticipate that grades along the alignment will generally remain the same with the exception of the cut area on the east side of the alignment. We should be notified if more than 3 feet of fill will be placed along the alignment. Additional analysis may be required to evaluate the soils for settlements. We should also be notified when the size of the box culverts are chosen. Additional bedding recommendations may be required based on the size of the pipe.

We have assumed the storm sewer will have invert depths ranging from approximately 4 to 10 feet and the watermain will have a minimum of 8 feet of cover over their tops.

C.1.b. Precautions Regarding Changed Information

We have attempted to describe our understanding of the proposed construction to the extent it was reported to us by others. Depending on the extent of available information, assumptions may have been made based on our experience with similar projects. If we have not correctly recorded or interpreted the project details, we should be notified. New or changed information could require additional evaluation, analyses and/or recommendations.

C.2. Design and Construction Considerations

C.2.a. Utilities

It appears from the borings that fat clays, lean clays, and silty sands will be encountered at the utility invert elevations. It is our opinion these soils will be suitable for support of the proposed utilities. Dewatering of the utility trenches will not likely be necessary along the alignment except near Hay Creek.

C.2.b. Pavement

We recommend the existing pavements be completely removed. We recommend the upper one (1) foot of the resulting subgrade be scarified, thoroughly mixed, moistened to a moisture content near optimum, and compacted to a minimum of 95 percent of its standard Proctor maximum dry density. On-site or imported backfills and fills should then be placed and compacted to desired grades.

Based on the soils observed in the borings and the results of our laboratory tests, we recommend the pavements be designed for a subgrade with a California Bearing Ratio (CBR) of 2.

D. Recommendations

D.1. Utilities

D.1.a. Excavation

We anticipate the excavations for the proposed utilities can be completed with a backhoe. A ripper tooth mounted on a backhoe may be necessary to loosen the Hell Creek Formation material. The existing fill soils and silty sands (SM) encountered in the borings are generally Type C soils under Department of Labor Occupational Safety and Health Administration (OSHA) guidelines. The natural fat clays (CH), lean clays (CL), shale and claystone will generally be Type B soils.

D.1.b. Dewatering

Groundwater was observed in two of the borings during drilling. We do not anticipate dewatering of the utility trenches will be required along the alignment with the exception of the Hay Creek area and the farthest eastern portion of the alignment. However, following spring thaw or wet weather, the aggregate base and upper fills could hold water and cause perched groundwater conditions. We anticipate dewatering can be accomplished by pumping from shallow trenches or sumps and with well points or dewater wells within the area of Hay Creek.

D.1.c. Trench Subgrades

For utility invert depths of less than 10 feet, the borings indicate naturally deposited fat clay, lean clay, and silty sand will be encountered in the bottoms of the trenches. It is our opinion the anticipated subgrade soils will be suitable for support of the proposed utilities.

D.1.d. Bedding

We recommend the pipes be bedded imported sands or sandy gravels (soils with less than 12 percent particles by weight passing the 200 sieve). Sands or sandy gravels meeting this requirement are generally noncorrosive. The bedding should be compacted firmly under and around the pipes.

D.1.e. Backfill and Fill

Soils excavated from the utility trenches may be reused as trench backfill. Soils containing organic materials should not be reused as backfill within 3 vertical feet of the proposed pavement subgrades.

D.1.f. Compaction

The trench backfill should be placed in thin lifts and compacted to a minimum of 95 percent of their maximum dry density determined in accordance with American Society for Testing and Materials (ASTM) Test Method D698 (standard Proctor). Clay soils should be moisture-conditioned to within 0 to 4 percentage points above their optimum moisture contents, and sandy or silty soils should be moisture-conditioned to within plus or minus 3 percentage points of their optimum moisture contents. Care should be taken to place the utility trench backfill within the recommended moisture content ranges to prevent or reduce differential settlements over the trenches.

D.2. Pavements

D.2.a. Subgrade Preparation

We recommend the existing pavements be completely removed. In the proposed widening and new alignment areas, we recommend all vegetation (grass, roots, trees, etc.) be removed from the pavement areas, and all topsoils and organic soils within 3 vertical feet of the proposed subgrade elevation also be removed. The removals should extend at least 1 foot horizontally behind the curbs, then upward and outward at a maximum 1/2H:1V slope.

Where black or organic soils are more than 3 feet below the bottom of the proposed aggregate base, it is our opinion they can be left in place if they are sufficiently stable to permit compaction of overlying material.

After removing the unwanted soils, we recommend the upper one (1) foot of the resulting subgrade be scarified, thoroughly mixed, moistened to a moisture content near optimum, and compacted to a minimum of 95 percent of its standard Proctor maximum dry density. If there are areas that cannot be adequately compacted, we recommend the unstable materials be subexcavated to a depth of about 2 to 3 feet and be replaced by materials which can be compacted.

Backfill and fill placed within 3 vertical feet of the pavement subgrades should consist of non-black on-site soils.

D.2.b. Anticipated Subgrades

After preparation, we anticipate the subgrades will consist of compacted fat clays and lean clays. Laboratory tests to evaluate the California Bearing Ratio (CBR) of the subgrade materials were performed from materials collected from Borings ST-1, ST-2, ST-3 and ST-8. The materials tested were fat clay (CH). The results of the tests are presented in Section B.3.c above. We recommend the pavements be designed for a subgrade with a CBR of 2. This CBR values reflect the subgrade soil strength at 95 percent compaction.

D.2.c. Subgrade Proofroll

After the subgrade has been prepared and compacted, we recommend test-rolling the pavement areas to check for localized soft or very loose areas. Loose or unstable areas observed will require additional stabilization, compaction and/or subexcavation of those materials. We recommend the test-rolling procedure be observed by a geotechnical engineer to assist in evaluating the suitability of the pavement subgrade.

D.2.d. Drainage Considerations

Where the pavements are underlain by non-granular soils (soils with more than 20 percent passing the #200 sieve), we recommend drainage be provided for the aggregate base. The fat clays and lean clays encountered in the borings are non-granular materials. Drainage will be necessary along the entire proposed alignment.

We recommend edge drains be constructed along the pavement edges in accordance with NDDOT Specifications 714.02E and 714.03E. If the edge drains were constructed continuously along the alignment, there will be a risk to developing excessive water pressures at the low portions of the alignment. Along the steep portions of the alignments (slopes of ≈ 10% or greater), we recommend capping the drains at intervals of 200 to 300 feet. Consideration may also be given to installing interceptor drains (drains constructed perpendicular to the roadway, extending across the width of the pavement) along the steep portions to reduce the potential for excessive water pressure within the aggregate base at the bottoms of the slopes.

Consideration should be given to placing a geotextile separation fabric over the fat clay and lean clay subgrades to provide better drainage of the pavements and maintain the thickness of the aggregate.

D.2.e. Materials and Compaction

We recommend the aggregate base meet the requirements of ND/DOT Specification 816.03B for Class 5 Aggregate Base. We recommend the aggregate base be compacted to a minimum of 95 percent of the standard Proctor maximum dry density.

D.3. Construction Quality Control

D.3.a. Excavation Observations

We recommend having a geotechnical engineer observe all excavations related to the pavement construction. The purpose of the observations is to evaluate the competence of the geologic materials exposed in the excavations, and the adequacy of required excavation oversizing.

D.3.b. Materials Testing

We recommend density testing be performed in all backfill and fill placed beneath pavements. Trench backfill should be tested every 500 feet at vertical intervals not exceeding 2 feet. We also recommend density testing of the compacted pavement subgrades, gravel base courses, and bituminous surfaces. Samples of proposed backfill and fill materials should be submitted to a testing laboratory at least three days prior to placement for evaluation of their suitability and determination of their optimum moisture contents and maximum dry densities.

D.3.c. Pavement Subgrade Proof-Roll

We recommend that proof-rolling of the pavement subgrades be observed by a geotechnical engineer to determine if the results of the procedure meet project specifications, or delineate the extent of additional pavement subgrade preparation work.

D.3.d. Cold Weather Precautions

If site grading and construction is anticipated during cold weather, all snow and ice should be removed from cut and fill areas prior to additional grading. No fill should be placed on frozen subgrades. No frozen soils should be used as fill.

Concrete delivered to the site should meet the temperature requirements of ASTM C 94. Concrete should not be placed on frozen subgrades. Concrete should be protected from freezing until the necessary strength is attained. Frost should not be permitted to penetrate below footings.

E. Procedures

E.1. Penetration Test Borings

The penetration test borings were drilled with a truck-mounted core and auger drill equipped with hollow-stem auger. The borings were performed in accordance with ASTM D 1586. Penetration test samples were taken at 2 1/2- or 5-foot intervals. Actual sample intervals and corresponding depths are shown on the boring logs.

E.2. Material Classification and Testing

E.2.a. Visual and Manual Classification

The geologic materials encountered were visually and manually classified in accordance with ASTM Standard Practice D 2488. A chart explaining the classification system is attached. Samples were placed in jars or bags and returned to our facility for review and storage.

E.2.b. Laboratory Testing

The results of the laboratory tests performed on geologic material samples are noted on or follow the appropriate attached exploration logs. The tests were performed in accordance with ASTM or AASHTO procedures.

E.3. Groundwater Measurements

The drillers checked for groundwater as the penetration test borings were advanced, and again after auger withdrawal. The boreholes were then backfilled or allowed to remain open for an extended period of observation as noted on the boring logs.

F. Qualifications

F.1. Variations in Subsurface Conditions

F.1.a. Material Strata

Our evaluation, analyses and recommendations were developed from a limited amount of site and

subsurface information. It is not standard engineering practice to retrieve material samples from exploration locations continuously with depth, and therefore strata boundaries and thicknesses must be inferred to some extent. Strata boundaries may also be gradual transitions, and can be expected to vary in depth, elevation and thickness away from the exploration locations.

Variations in subsurface conditions present between exploration locations may not be revealed until additional exploration work is completed, or construction commences. If any such variations are revealed, our recommendations should be re-evaluated. Such variations could increase construction costs, and a contingency should be provided to accommodate them.

F.1.b. Groundwater Levels

Groundwater measurements were made under the conditions reported herein and shown on the exploration logs, and interpreted in the text of this report. It should be noted that the observation periods were relatively short, and groundwater can be expected to fluctuate in response to rainfall, flooding, irrigation, seasonal freezing and thawing, surface drainage modifications and other seasonal and annual factors.

F.2. Continuity of Professional Responsibility

F.2.a. Plan Review

This report is based on a limited amount of information, and a number of assumptions were necessary to help us develop our recommendations. It is recommended that our firm review the geotechnical aspects of the designs and specifications, and evaluate whether the design is as expected, if any design changes have affected the validity of our recommendations, and if our recommendations have been correctly interpreted and implemented in the designs and specifications.

F.2.b. Construction Observations and Testing

It is recommended that we be retained to perform observations and tests during construction. This will allow correlation of the subsurface conditions encountered during construction with those encountered by the borings, and provide continuity of professional responsibility.

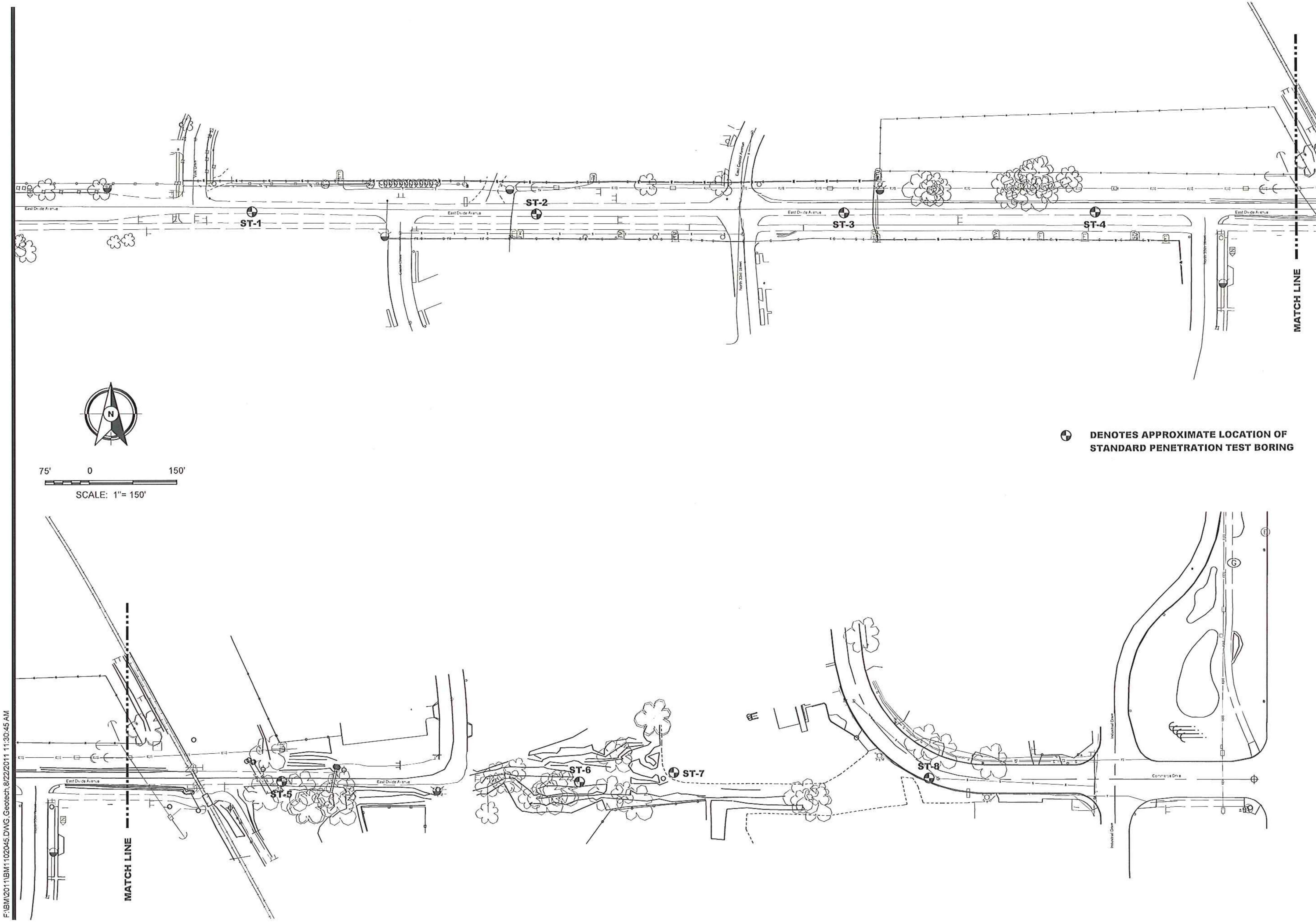
F.3. Use of Report

This report is for the exclusive use of the parties to which it has been addressed. Without written approval, we assume no responsibility to other parties regarding this report. Our evaluation, analyses and recommendations may not be appropriate for other parties or projects.

F.4. Standard of Care

In performing its services, Braun Intertec used that degree of care and skill ordinarily exercised under similar circumstances by reputable members of its profession currently practicing in the same locality. No warranty, express or implied, is made.

Appendix



BRAUN INTERTEC

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PH. (952) 995-2000
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Base Dwg Provided By:

SOIL BORING LOCATION SKETCH
GEOTECHNICAL EVALUATION
DIVIDE AVENUE RECONSTRUCTION
VOLK DRIVE TO EAST BISMARCK EXPRESSWAY
BISMARCK, NORTH DAKOTA

Project No: BM1102045

Drawing No: BM1102045

Scale:	1"= 150'
Drawn By:	JAG
Date Drawn:	8/22/11
Checked By:	MEK
Last Modified:	8/22/11

Sheet: of | Fig:

BRAUN INTERTEC

LOG OF BORING

Braun Project BM-11-02045
Geotechnical Evaluation
Divide Avenue Reconstruction
Volk Drive to East Bismarck Expressway
Bismarck, North Dakota

BORING: **ST-01**

LOCATION: See Sketch.

DRILLER: S. Wenko | METHOD: 3 1/4" HSA, Autohammer | DATE: **7/15/11** | SCALE: **1" = 5'**

(See Descriptive Terminology sheet for explanation of abbreviations)

Elev. feet	Depth feet	Symbol	Description of Materials (Soil- ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	qp tsf	MC %	Tests or Notes
1766.8	0.0							
1766.5	0.3	BIT	4" Bituminous Surface.	7				
1765.8	1.0	AGG	8" Aggregate Base.					
1765.3	1.5	FILL	FILL: Fat Clay, trace Sand, brown and gray, moist.					
		CLST	HELL CREEK FORMATION, CLAYSTONE, gray, moist, decomposed, very soft, hand deformed sample classified as "Fat Clay (CH)".	11			33	
				20		4.5+	32	LL=69, PL=22, PI=47
				23		4.5+		
				22		4.5+	32	
				22		4.5+		
				23		4.5+	28	
1745.8	21.0			20		4.5+		
			END OF BORING. Water not observed with 19 1/2 feet of hollow stem auger in the ground. Boring then backfilled.					

LOG OF BORING N:\GINT\PROJECTS\BISMARCK\2011\02045.GPJ BRAUN_V8_CURRENT.GDT 8/18/11 12:55

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LOG OF BORING

Braun Project BM-11-02045
Geotechnical Evaluation
Divide Avenue Reconstruction
Volk Drive to East Bismarck Expressway
Bismarck, North Dakota

BORING: **ST-02**

LOCATION: See Sketch.

DRILLER: S. Wenko | METHOD: 3 1/4" HSA, Autohammer | DATE: 7/15/11 | SCALE: 1" = 5'

Elev. feet	Depth feet	Symbol	Description of Materials (Soil- ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	qp tsf	MC %	Tests or Notes
1759.7	0.0							
1759.3	0.4	BIT	5" Bituminous Surfacing.	5				
1758.9	0.8	AGG	4" Aggregate Base.					
		FILL	FILL: Fat Clay, brown and gray, moist.	*5				*No Recovery.
1755.7	4.0	SH	HELL CREEK FORMATION, SHALE, gray, decomposed, very soft, hand deformed sample classified as "Fat Clay (CH)".	14		2 1/2	30	
				21		4.5+		
				21		4.5+	30	
				23		4.5+		
				26		4.5+	22	
1738.7	21.0			26		4.5+		
			END OF BORING. Water not observed with 19 1/2 feet of hollow stem auger in the ground. Boring then backfilled.					

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING N:\GINT\PROJECTS\BISMARCK\2011\02045.GPJ BRAUN_V8_CURRENT.GDT 8/18/11 12:55

BRAUN INTERTEC

LOG OF BORING

Braun Project BM-11-02045
Geotechnical Evaluation
Divide Avenue Reconstruction
Volk Drive to East Bismarck Expressway
Bismarck, North Dakota

BORING: **ST-03**

LOCATION: See Sketch.

DRILLER: S. Wenko | METHOD: 3 1/4" HSA, Autohammer | DATE: 7/15/11 | SCALE: 1" = 5'

(See Descriptive Terminology sheet for explanation of abbreviations)

Elev. feet	Depth feet	Symbol	Description of Materials (Soil- ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	qp tsf	MC %	Tests or Notes
1737.2	0.0							
1736.8	0.4	BIT	5" Bituminous Surfacing.	6				
1736.2	1.0	AGG	7 1/2" Aggregate Base.					
		FILL	FILL: Fat Clay, brown, dark brown, and gray, moist.	7			30	
1733.2	4.0	FILL	FILL: Silty Sand, fine-grained, with a few clay lenses, brown, moist.	9			22	
1730.7	6.5	SH	HELL CREEK FORMATION, SHALE, gray, moist, decomposed, very soft, hand deformed sample classified as "Fat Clay (CH)"	16				
				17		4.5+		
				23				
				24		4.5+		LL=52, PL=26, PI=26
1716.2	21.0			26		4.5+		
			END OF BORING. Water not observed with 19 1/2 feet of hollow stem auger in the ground. Boring then backfilled.					

LOG OF BORING N:\GINT\PROJECTS\BISMARCK\2011\02045.GPJ BRAUN_V8_CURRENT.GDT 8/18/11 12:55

BRAUN INTERTEC

LOG OF BORING

Braun Project BM-11-02045
Geotechnical Evaluation
Divide Avenue Reconstruction
Volk Drive to East Bismarck Expressway
Bismarck, North Dakota

BORING: **ST-04**

LOCATION: See Sketch.

DRILLER: S. Wenko | METHOD: 3 1/4" HSA, Autohammer | DATE: 7/15/11 | SCALE: 1" = 5'

Elev. feet	Depth feet	Symbol	Description of Materials (Soil- ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	qp tsf	MC %	Tests or Notes
1706.7	0.0							
1706.4	0.3	BIT	3 1/2" Bituminous Surfacing.	17				
1705.6	1.1	AGG	8" Aggregate Base.					
1705.2	1.5	FILL	FILL: Mixed Lean Clay and Fat Clay, dark brown and brown, damp to moist.	*6				*No Recovery.
		SH	HELL CREEK FORMATION, SHALE, gray, decomposed, very soft, hand deformed sample classified as "Fat Clay (CH)".	10			26	
				15		4.5+	27	
				17				
				25		4.5+		
				29		4.5+	22	
1685.7	21.0			27		4.5+		
			END OF BORING. Water not observed with 19 1/2 feet of hollow stem auger in the ground. Boring then backfilled.					

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING N:\GINT\PROJECTS\BISMARCK\2011\02045.GPJ BRAUN_V8_CURRENT.GDT 8/18/11 12:55

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LOG OF BORING

Braun Project BM-11-02045
Geotechnical Evaluation
Divide Avenue Reconstruction
Volk Drive to East Bismarck Expressway
Bismarck, North Dakota

BORING: **ST-05**

LOCATION: See Sketch.

DRILLER: S. Wenko | METHOD: 3 1/4" HSA, Autohammer | DATE: 7/15/11 | SCALE: 1" = 5'

(See Descriptive Terminology sheet for explanation of abbreviations)

Elev. feet	Depth feet	Symbol	Description of Materials (Soil- ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	qp tsf	MC %	Tests or Notes
1678.5	0.0							
1678.1	0.4	BIT	5" Bituminous Surfacing.					
1677.3	1.2	AGG	9" Aggregate Bse.	20				
1676.5	2.0	FILL	FILL: Mixed Lean Clay and Fat Clay, with Sand, dark brown and brown, damp to moist.					
		FILL		9				
1674.5	4.0		FILL: Silty Sand, fine-grained, brown with a few dark brown fragments, moist.		▽			
		SM	SILTY SAND, fine-grained, with a few clay lenses, brown, waterbearing, very loose to loose. (Alluvium)	3			23	
				5			25	
				4			31	
1667.0	11.5	CL	LEAN CLAY with SAND, brown and gray, wet, rather soft to soft. (Alluvium)	4		3/4	36	
				5		1	39	LL=48, PL=19, PI=29
				3		1/2		
			- trace Gravel at 25 feet.	5				
1647.5	31.0			4		2 1/2		
			END OF BORING.					
			Water observed at a depth of 4 feet while drilling.					
			Boring then backfilled.					

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BRAUN INTERTEC

LOG OF BORING

Braun Project BM-11-02045
Geotechnical Evaluation
Divide Avenue Reconstruction
Volk Drive to East Bismarck Expressway
Bismarck, North Dakota

BORING: **ST-06**

LOCATION: See Sketch.

DRILLER: S. Wenko | METHOD: 3 1/4" HSA, Autohammer | DATE: 7/14/11 | SCALE: 1" = 5'

(See Descriptive Terminology sheet for explanation of abbreviations)

Elev. feet	Depth feet	Symbol	Description of Materials (Soil- ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	Tests or Notes
1709.7	0.0						
1709.6	0.1	FILL	FILL: Silty Sand, fine-grained, dark brown, moist.	7			
1708.2	1.5	FILL	FILL: Silty Sand, fine-grained, trace Gravel, brown with a few clay lenses, moist.				
		FILL	FILL: Lean Clay with Sand, trace Gravel, brown, moist.	5		17	
1705.7	4.0	CLST	HELL CREEK FORMATION, CLAYSTONE, brown, moist, decomposed, very soft, hand deformed sample classified as "Fat Clay (CH)".	5			
				TW			
				27			LL=53, PL=24, PI=29
1698.2	11.5	SS	HELL CREEK FORMATION, SANDSTONE, brown, moist, decomposed, very soft, sample retrieved as non-cemented "Silty Sand (SM)".	24		28	
				20			
1691.7	18.0	SH	HELL CREEK FORMATION, SHALE, gray, moist, decomposed, very soft, hand deformed sample classified as "Fat Clay (CH)"				
1688.7	21.0			24			
			END OF BORING.				
			Water not observed with 19 1/2 feet of hollow stem auger in the ground.				
			Boring then backfilled.				

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BRAUN INTERTEC

LOG OF BORING

Braun Project BM-11-02045
Geotechnical Evaluation
Divide Avenue Reconstruction
Volk Drive to East Bismarck Expressway
Bismarck, North Dakota

BORING: **ST-07**

LOCATION: See Sketch.

DRILLER: S. Wenko | METHOD: 3 1/4" HSA, Autohammer | DATE: 7/14/11 | SCALE: 1" = 5'

(See Descriptive Terminology sheet for explanation of abbreviations)

Elev. feet	Depth feet	Symbol	Description of Materials (Soil- ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	qp tsf	MC %	Tests or Notes
1721.7	0.0	FILL	FILL: Lean Clay with Gravel, brown and dark brown, moist.	6		1 1/2		
			- Bituminous pieces at 3 feet.	12		2 1/2	21	
1717.2	4.5	ML	SILT, with a few clay lenses, brown, wet, rather soft. (Alluvium)	5		1 1/2	33	
1715.2	6.5	CH	FAT CLAY, gray, moist, rather soft. (Alluvium)	5				
1712.7	9.0	SM	SILTY SAND, fine-grained, with a few Clay lenses, brown, moist, very loose. (Alluvium)	4			21	
1709.7	12.0	CLST	HELL CREEK FORMATION, CLAYSTONE, brown, moist, decomposed, very soft, hand deformed sample classified as "Fat Clay (CH)".	3		1/2	32	
				8		1 1/2		
				15		3		
				30		2 1/2		LL=55, PL=19, PI=36
1693.7	28.0	SH	HELL CREEK FORMATION, SHALE, gray, decomposed, very soft, hand deformed sample classified as "Fat Clay (CH)".	32		4.5+		
1690.7	31.0		END OF BORING. Water not observed with 29 1/2 feet of hollow stem auger in the ground. Boring then backfilled.					

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LOG OF BORING

Braun Project BM-11-02045
Geotechnical Evaluation
Divide Avenue Reconstruction
Volk Drive to East Bismarck Expressway
Bismarck, North Dakota

BORING: **ST-08**

LOCATION: See Sketch.

DRILLER: S. Wenko | METHOD: 3 1/4" HSA, Autohammer | DATE: 7/15/11 | SCALE: 1" = 5'

Elev. feet	Depth feet	Symbol	Description of Materials (Soil- ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	qp tsf	MC %	Tests or Notes
1721.1	0.0							
1720.8	0.3	BIT	4" Bituminous Surfacing.					
1719.9	1.2	AGG	9" Aggregate Base.	10				
		FILL	FILL: Mixed Lean Clay and Fat Clay, trace Sand, brown and dark brown, moist.	6		1	26	
				5		1	17	
1714.6	6.5	CL	LEAN CLAY, dark brown to black, moist. (Buried Topsoil)	10		2	23	
1712.1	9.0	SM	SILTY SAND, fine- to medium-grained, trace Gravel, brown, moist, loose to medium dense. (Alluvium)	11			20	
1707.1	14.0			9		2		
		CL	LEAN CLAY, brown, moist, rather soft. (Alluvium)	5		1 1/2	36	
1703.1	18.0	ML	SANDY SILT, wet, brown, very loose. (Alluvium)		▽			
1700.1	21.0			4		1/2	31	
			END OF BORING. Water observed at a depth of 20 feet while drilling. Boring then backfilled.					

(See Descriptive Terminology sheet for explanation of abbreviations)

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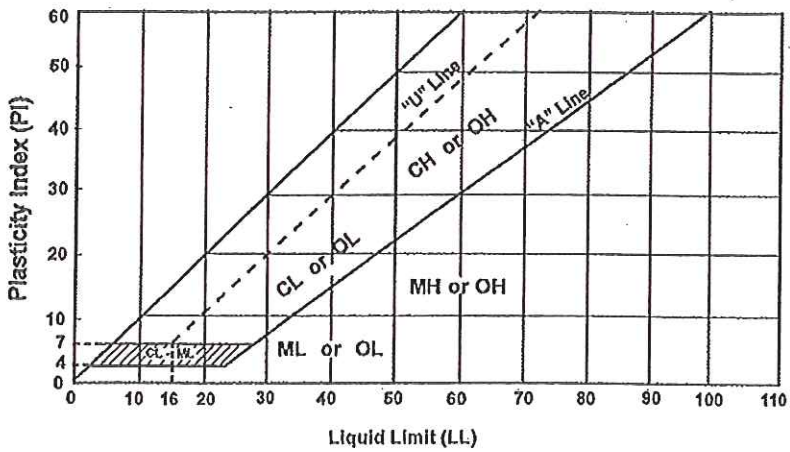
Descriptive Terminology of Soil

Standard D 2487 - 00
Classification of Soils for Engineering Purposes
(Unified Soil Classification System)

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [a]				Soils Classification	
				Group Symbol	Group Name [b]
Coarse-grained Soils more than 50% retained on No. 200 sieve	Gravels More than 50% of coarse fraction retained on No. 4 sieve	Clean Gravels 5% or less fines [e]	$C_u \geq 4$ and $1 \leq C_c \leq 3$ [c]	GW	Well-graded gravel [d]
			$C_u < 4$ and/or $1 > C_c > 3$ [c]	GP	Poorly graded gravel [d]
		Gravels with Fines More than 12% fines [e]	Fines classify as ML or MH	GM	Silty gravel [d f g]
			Fines classify as CL or CH	GC	Clayey gravel [d f g]
	Sands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands 5% or less fines [i]	$C_u \geq 6$ and $1 \leq C_c \leq 3$ [c]	SW	Well-graded sand [h]
			$C_u < 6$ and/or $1 > C_c > 3$ [c]	SP	Poorly graded sand [h]
		Sands with Fines More than 12% [i]	Fines classify as ML or MH	SM	Silty sand [f g h]
			Fines classify as CL or CH	SC	Clayey sand [f g h]
Fine-grained Soils 50% or more passed the No. 200 sieve	Silts and Clays Liquid limit less than 50	Inorganic	PI > 7 and plots on or above "A" line [j]	CL	Lean clay [k l m]
			PI < 4 or plots below "A" line [j]	ML	Silt [k l m]
		Organic	Liquid limit - oven dried / Liquid limit - not dried < 0.75	OL	Organic clay [k l m n] / Organic silt [k l m o]
	Silts and clays Liquid limit 50 or more	Inorganic	PI plots on or above "A" line	CH	Fat clay [k l m]
			PI plots below "A" line	MH	Elastic silt [k l m]
		Organic	Liquid limit - oven dried / Liquid limit - not dried < 0.75	OH	Organic clay [k l m p] / Organic silt [k l m q]
Highly Organic Soils		Primarily organic matter, dark in color and organic odor		PT	Peat

a. Based on the material passing the 3-in (75mm) sieve.
b. If field sample contained cobbles or boulders, or both, add "with cobbles or boulders or both" to group name.
c. $C_u = D_{60}/D_{10}$ $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$
d. If soil contains ≥15% sand, add "with sand" to group name.
e. Gravels with 5 to 12% fines require dual symbols:
GW-GM well-graded gravel with silt
GW-GC well-graded gravel with clay
GP-GM poorly graded gravel with silt
GP-GC poorly graded gravel with clay
f. If fines classify as CL-ML, use dual symbol GC-GM or SC-SM.
g. If fines are organic, add "with organic fines" to group name.
h. If soil contains ≥ 15% gravel, add "with gravel" to group name.
i. Sands with 5 to 12% fines require dual symbols:
SW-SM well-graded sand with silt
SW-SC well-graded sand with clay
SP-SM poorly graded sand with silt
SP-SC poorly graded sand with clay
j. If Atterberg limits plot in hatched area, soil is a CL-ML, silty clay.
k. If soil contains 10 to 29% plus No. 200, add "with sand" or "with gravel" whichever is predominant.
l. If soil contains ≥ 30% plus No. 200, predominantly sand, add "sandy" to group name.
m. If soil contains ≥ 30% plus No. 200 predominantly gravel, add "gravelly" to group name.
n. PI ≥ 4 and plots on or above "A" line.
o. PI < 4 or plots below "A" line.
p. PI plots on or above "A" line.
q. PI plots below "A" line.



Laboratory Tests

DD	Dry density, pcf	OC	Organic content, %
WD	Wet density, pcf	S	Percent of saturation, %
MC	Natural moisture content, %	SG	Specific gravity
LL	Liquid limit, %	C	Cohesion, psf
PL	Plastic limit, %	∅	Angle of internal friction
PI	Plasticity index, %	qu	Unconfined compressive strength, psf
P200	% passing 200 sieve	qp	Pocket penetrometer strength, tsf

Particle Size Identification

Boulders	over 12"
Cobbles	3" to 12"
Gravel	
Coarse	3/4" to 3"
Fine	No. 4 to 3/4"
Sand	
Coarse	No. 4 to No. 10
Medium	No. 10 to No. 40
Fine	No. 40 to No. 200
Silt	<No. 200, PI<4 or below "A" line
Clay	<No. 200, PI≥4 and on or above "A" line

Relative Density of Cohesionless Soils

Very loose	0 to 4 BPF
Loose	5 to 10 BPF
Medium dense	11 to 30 BPF
Dense	31 to 50 BPF
Very dense	over 50 BPF

Consistency of Cohesive Soils

Very soft	0 to 1 BPF
Soft	2 to 3 BPF
Rather soft	4 to 5 BPF
Medium	6 to 8 BPF
Rather stiff	9 to 12 BPF
Stiff	13 to 16 BPF
Very stiff	17 to 30 BPF
Hard	over 30 BPF

Drilling Notes

Standard penetration test borings were advanced by 3 1/4" or 6 1/4" ID hollow-stem augers unless noted otherwise. Jetting water was used to clean out auger prior to sampling only where indicated on logs. Standard penetration test borings are designated by the prefix "ST" (Split Tube). All samples were taken with the standard 2" OD split-tube sampler, except where noted.

Power auger borings were advanced by 4" or 6" diameter continuous-flight, solid-stem augers. Soil classifications and strata depths were inferred from disturbed samples augered to the surface and are, therefore, somewhat approximate. Power auger borings are designated by the prefix "B."

Hand auger borings were advanced manually with a 1 1/2" or 3 1/4" diameter auger and were limited to the depth from which the auger could be manually withdrawn. Hand auger borings are indicated by the prefix "H."

BPF: Numbers indicate blows per foot recorded in standard penetration test, also known as "N" value. The sampler was set 6" into undisturbed soil below the hollow-stem auger. Driving resistances were then counted for second and third 6" increments and added to get BPF. Where they differed significantly, they are reported in the following form: 2/12 for the second and third 6" increments, respectively.

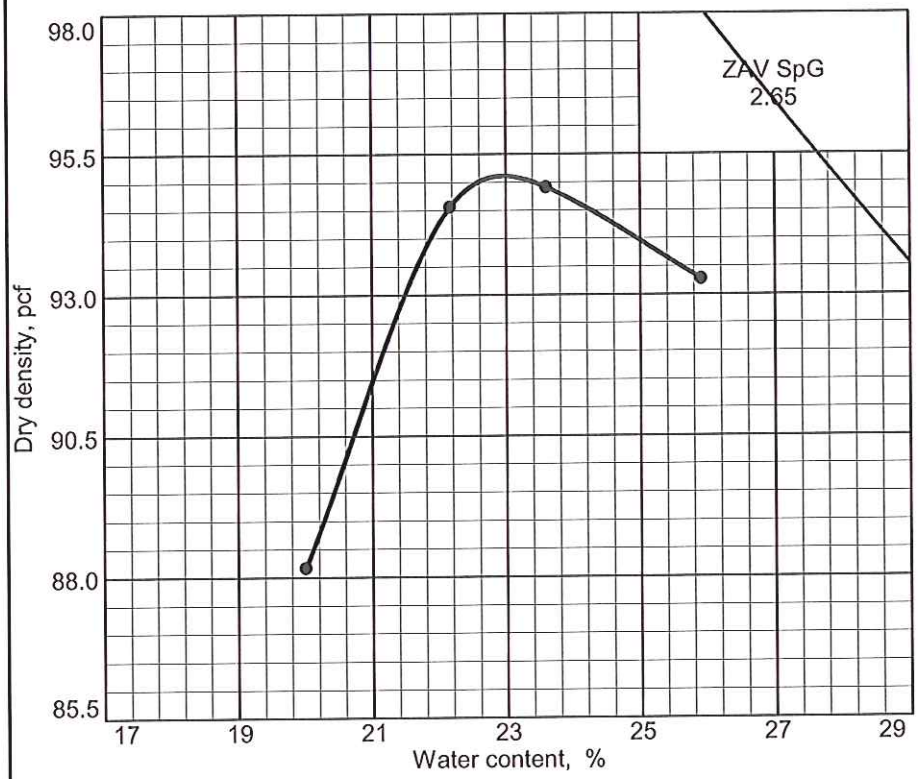
WH: WH indicates the sampler penetrated soil under weight of hammer and rods alone; driving not required.

WR: WR indicates the sampler penetrated soil under weight of rods alone; hammer weight and driving not required.

TW indicates thin-walled (undisturbed) tube sample.

Note: All tests were run in general accordance with applicable ASTM standards.

Moisture-Density Relationship



Curve No.
P-01

Test Specification:
ASTM D 698-07e1 Method A Standard

Hammer Wt.: 5.5 lb.
Hammer Drop: 12 in.
Number of Layers: five
Blows per Layer: 25
Mold Size: .03334 cu.ft.

Test Performed on Material Passing No.4 **Sieve**

Soil Data

NM _____ **Sp.G.** 2.65
LL _____ **PI** _____
%>No.4 3.0 **%<#200** 86.5
USCS CH **AASHTO** _____

TESTING DATA

	1	2	3	4	5	6
WM + WS	5820.0	5967.0	5994.0	5996.0		
WM	4220.0	4220.0	4220.0	4220.0		
WW + T #1	553.80	563.70	489.10	565.50		
WD + T #1	503.50	508.40	430.20	503.80		
TARE #1	252.00	258.90	180.60	265.60		
WW + T #2						
WD + T #2						
TARE #2						
MOISTURE	20.0	22.2	23.6	25.9		
DRY DENSITY	88.2	94.6	94.9	93.3		

TEST RESULTS

Maximum dry density = 95.1 pcf

Optimum moisture = 23.0 %

Material Description

Fat Clay, brown

Project No. BM-11-02045 **Client:** Kadrmas, Lee & Jackson, Inc.
Project: Divide Avenue Reconstruction Bismarck, ND
MK
● **Source:** **Sample No.:** P-01

Remarks:
Specific Gravity was assumed.
Composite (ST-1 + ST-2) 1'5'
8/4/11

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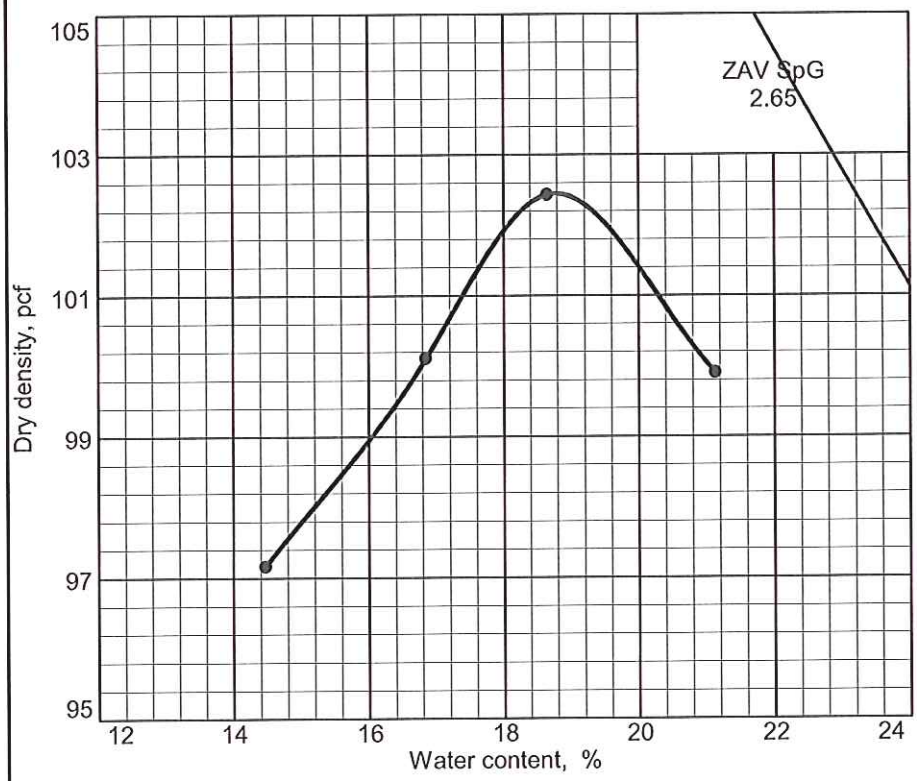
Moisture-Density Relationship



Curve No.
P-02

Test Specification:
ASTM D 698-07e1 Method A Standard

Hammer Wt.: 5.5 lb.
Hammer Drop: 12 in.
Number of Layers: five
Blows per Layer: 25
Mold Size: .03334 cu.ft.

Test Performed on Material Passing No.4 **Sieve**

Soil Data

NM		**Sp.G.**	2.65
LL		**PI**	
%>No.4	5.0	**%<#200**	85.9
USCS	CH	**AASHTO**	

TESTING DATA

	1	2	3	4	5	6
WM + WS	5895.0	5982.0	6051.0	6043.0		
WM	4213.0	4213.0	4213.0	4213.0		
WW + T #1	534.70	486.10	487.90	537.30		
WD + T #1	496.00	442.20	439.90	484.10		
TARE #1	228.50	181.60	182.50	232.30		
WW + T #2						
WD + T #2						
TARE #2						
MOISTURE	14.5	16.8	18.6	21.1		
DRY DENSITY	97.2	100.1	102.4	99.9		

TEST RESULTS

Maximum dry density = 102.5 pcf

Optimum moisture = 18.8 %

Material Description

Fat Clay, brown

Project No. BM-11-02045 **Client:** Kadrmas, Lee & Jackson, Inc.

Project: Divide Avenue Reconstruction Bismarck, ND

MK

● **Source:** **Sample No.:** P-02

Remarks:

Specific Gravity was assumed.
Composite (ST-3 + ST-8) 1'-5'
8/4/11

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California Bearing Ratio Test Report

Minneapolis Laboratory
Braun Intertec Corporation
Phone: 701.255.7180

Report No: CBR:W11-001736-S1
Issue No: 1

Client: Nick West
Kadrmas, Lee & Jackson, Inc.
128 Soo Line Dr
Bismarck, ND, 58502-1157

Project: BM-11-02045
Divide Avenue Reconstruction
Volk Drive to Expressway
Bismarck, ND, 58501

PM: Mark E. Kvas, mkvas@BraunIntertec.com

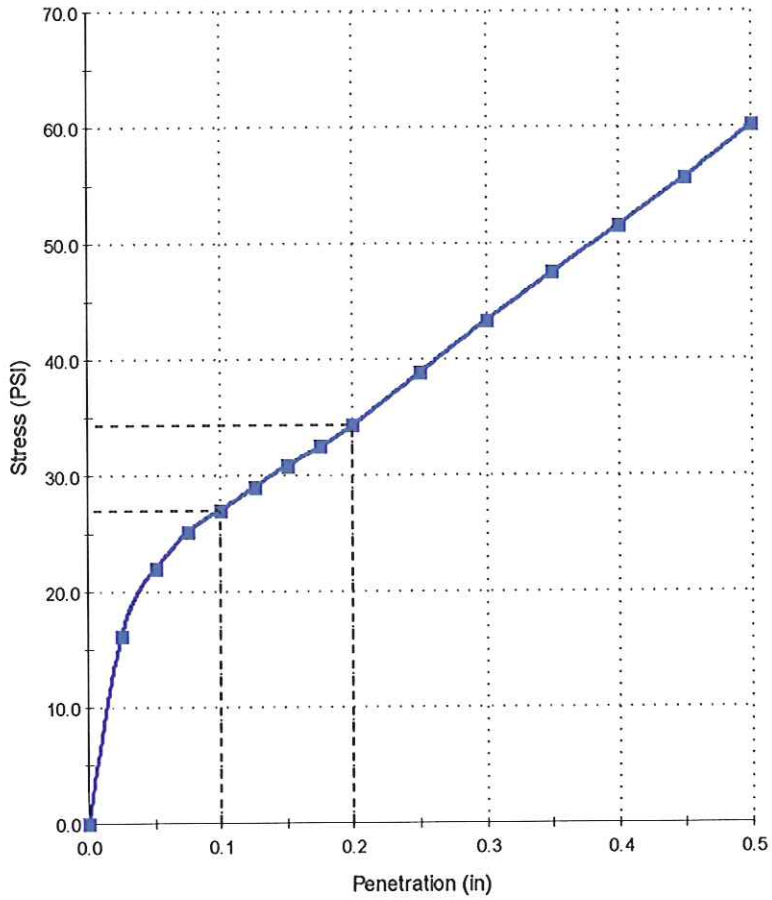
Jason Limley

Jason Limley
Laboratory Technician III
Date of Issue: 8/9/2011

Sample Details

Sample ID:	W11-001736-S1	**Alternate Sample ID:**	
Sampled By:	Steve Wenko	**Date Sampled:**	7/15/2011
Sampling Method:	Soil Boring Auger	**Source:**	
Material:		**Specification:**	
Sample Location:	Composite (ST-1 and ST-2) 1'-5'		

Stress vs Penetration



Test Results

ASTM D 1883 - 07

CBR At 0.1in (%):	2.7
CBR At 0.2in (%):	2.3
Compactive Effort:	ASTM D 698
Number of Blows:	40
% of Maximum Dry Density:	95.7
Dry Density Before Soaking (lb/ft³):	91.0
MC Before Compaction (%):	23.3
MC After Compaction (%):	23.2
Moisture Content of Top 1in (%):	30.2
Average Moisture Content (%):	
Maximum Dry Density (lb/ft³):	95.1
Optimum Moisture Content (%):	23.0
Sample Condition:	soaked
Swell (%):	5.1
Surcharge Mass (lb):	10.00
Oversize Material (%):	0.0
Date Tested:	8/9/2011

Comments

BRAUN INTERTEC

California Bearing Ratio Test Report

Minneapolis Laboratory
Braun Intertec Corporation
Phone: 701.255.7180

Report No: CBR:W11-001736-S2
Issue No: 1

Client: Nick West
Kadrmas, Lee & Jackson, Inc.
128 Soo Line Dr
Bismarck, ND, 58502-1157

Project: BM-11-02045
Divide Avenue Reconstruction
Volk Drive to Expressway
Bismarck, ND, 58501

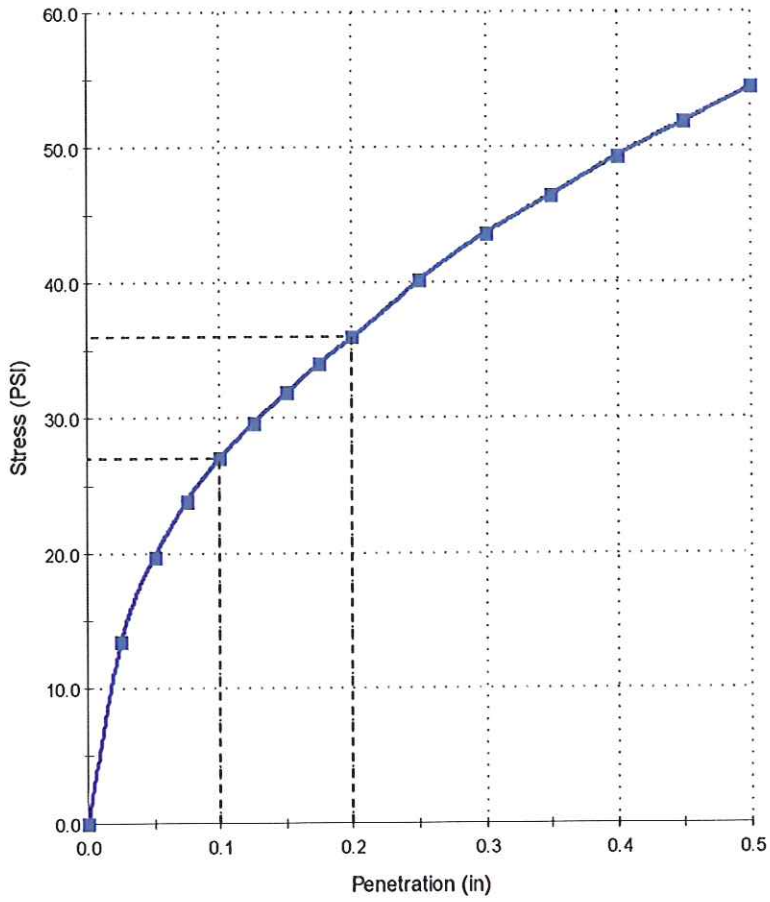
PM: Mark E. Kvas, mkvas@BraunIntertec.com

Jason Limley
Laboratory Technician III
Date of Issue: 8/9/2011

Sample Details

Sample ID:	W11-001736-S2	**Alternate Sample ID:**	
Sampled By:	Steve Wenko	**Date Sampled:**	7/15/2011
Sampling Method:	Soil Boring Auger	**Source:**	
Material:		**Specification:**	
Sample Location:	Composite (ST-3 and ST-8) 1'-5'		

Stress vs Penetration



Test Results

ASTM D 1883 - 07

CBR At 0.1in (%):	2.7
CBR At 0.2in (%):	2.4
Compactive Effort:	ASTM D 698
Number of Blows:	34
% of Maximum Dry Density:	95.4
Dry Density Before Soaking (lb/ft³):	97.8
MC Before Compaction (%):	18.7
MC After Compaction (%):	18.6
Moisture Content of Top 1in (%):	25.5
Average Moisture Content (%):	
Maximum Dry Density (lb/ft³):	102.5
Optimum Moisture Content (%):	18.8
Sample Condition:	soaked
Swell (%):	3.7
Surcharge Mass (lb):	10.00
Oversize Material (%):	0.0
Date Tested:	8/9/2011

Comments